Claims

1. A method for reproducing a contone image as a halftone image on a recording medium, using threshold values in a threshold matrix, comprising the steps of:

(a) providing a base supercell suitable for periodically tiling a plane, the base supercell having a plurality of microdots and a plurality of virtual halftone dot centers;

(b) assigning an ordering sequence comprising a series of numbers on the virtual halftone dot centers in the base supercell by:

(i) assigning a first number in the ordering sequence to a first virtual halftone dot center in the base supercell;

(ii) assigning a second consecutive number in the ordering sequence to a second virtual halftone dot center in the base supercell;

(iii) calculating a value of an aggregate distance function for each virtual halftone dot center in the base supercell not already included in the ordering sequence;

(iv) selecting a next virtual halftone dot center in the base supercell in response to the calculated aggregate distance function, the next virtual halftone dot center having one of the least values of the calculated aggregate distance function;

(v) assigning the next consecutive number in the ordering sequence to the selected next virtual halftone dot center in the base supercell; and

(vi) repeating steps (iii), (iv), and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence;

(c) assigning threshold values to microdots in response to the ordering sequence thereby generating the threshold matrix in the base supercell; and

(d) using the threshold matrix in combination with the contone image to generate a screened halftone image on the recording medium.

2. The method of claim 1, wherein the aggregate distance function for each virtual halftone dot center comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence, with each of the distances raised to a positive power.

3. The method of claim 1, wherein the positive power is 1.5.

4. The method of claim 1, wherein the positive power is 2.

5. The method of claim 1, wherein the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

6. The method of claim 5, wherein the distance between the second virtual halftone dot center and the first virtual halftone dot center does not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell.

7. The method of claim 1, wherein the second virtual halftone dot center is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

8. The method of claim 1, wherein the plurality of virtual halftone dot centers in the base supercell is arranged on a periodic grid having a screen angle and screen ruling.

9. The method of claim 1, further comprising, after step (c) and prior to step (d), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image.

10. A screen, suitable for the transformation of a contone image into a halftone image, said screen comprising a plurality of discrete spotlike zones arranged on grid points of a periodic grid defined by a screen angle and a screen ruling, wherein the spotlike zones are generated by using threshold values in a threshold matrix, the threshold matrix produced by:

(a) providing a base supercell suitable for periodically tiling a plane, the base supercell having a plurality of microdots and a plurality of virtual halftone dot centers;

(b) assigning an ordering sequence comprising a series of numbers on the virtual halftone dot centers in the base supercell by:

(i) assigning a first number in the ordering sequence to a first virtual halftone dot center in the base supercell;

(ii) assigning a second consecutive number in the ordering sequence to a second virtual halftone dot center in the base supercell;

(iii) calculating a value of an aggregate distance function for each virtual halftone dot center in the base supercell not already included in the ordering sequence;

(iv) selecting a next virtual halftone dot center in the base supercell in response to the calculated aggregate distance function, the next virtual halftone dot center having one of the least values of the calculated aggregate distance function;

(v) assigning the next consecutive number in the ordering sequence to the selected next virtual halftone dot center in the base supercell; and

(vi) repeating steps (iii), (iv), and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence;

(c) assigning threshold values to microdots in response to the ordering sequence thereby generating the threshold matrix in the base supercell.

11. The screen of claim 10, wherein the aggregate distance function for each virtual halftone dot center comprises a sum of inverse distances from said virtual halftone dot

center to each virtual halftone dot center already included in the ordering sequence; with each of the distances raised to a positive power.

12. The screen of claim 10, wherein the positive power is 1.5.

13. The screen of claim 10, wherein the positive power is 2.

14. The screen of claim 10, wherein the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

15. The screen of claim 14, wherein the distance between the second virtual halftone dot center and the first virtual halftone dot center does not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell.

16. The screen of claim 10, wherein the second virtual halftone dot center is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

17. The screen of claim 10, wherein the plurality of virtual halftone dot centers in the base supercell is arranged on a periodic grid having a screen angle and screen ruling.

18. The screen of claim 10, further comprising, after step (c), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image.

19. A screening system for converting contone image information to a halftone image information, the screening system comprising means for generating, retrieving or storing a screen suited for the transformation of a continuous tone image into a halftone image,

wherein said screen comprises a plurality of discrete spotlike zones generated by using threshold values in a threshold matrix, the threshold matrix produced by:

(a) providing a base supercell suitable for periodically tiling a plane, the base supercell having a plurality of microdots and a plurality of virtual halftone dot centers arranged on a periodic grid having a screen angle and screen ruling;

(b) assigning an ordering sequence comprising a series of numbers on the virtual halftone dot centers in the base supercell by:

(i) assigning a first number in the ordering sequence to a first virtual halftone dot center in the base supercell;

(ii) assigning a second consecutive number in the ordering sequence to a second virtual halftone dot center in the base supercell;

(iii) calculating a value of an aggregate distance function for each virtual halftone dot center in the base supercell not already included in the ordering sequence;

(iv) selecting a next virtual halftone dot center in the base supercell in response to the calculated aggregate distance function, the next virtual halftone dot center having one of the least values of the calculated aggregate distance function;

(v) assigning the next consecutive number in the ordering sequence to the selected next virtual halftone dot center in the base supercell; and

(vi) repeating steps (iii), (iv), and (v), until each virtual halftone dot center in the base supercell is included in the ordering sequence;

(c) assigning threshold values to microdots in response to the ordering sequence thereby generating the threshold matrix in the base supercell.

20. The screening system of claim 19, wherein the aggregate distance function for each virtual halftone dot center comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the ordering sequence; each of the distances raised to a positive power.

21. The screening system of claim 20, wherein the positive power is 1.5.

22. The screening system of claim 20, wherein the positive power is 2.

23. The screening system of claim 19, wherein the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

24. The screening system of claim 23, wherein the distance between the second virtual halftone dot center and the first virtual halftone dot center does not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell.

25. The screening system of claim 23, wherein the second virtual halftone dot center is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

26. The screening system of claim 19, wherein the plurality of discrete spotlike zones is arranged on grid points of a periodic grid, defined by a screen angle and a screen ruling.

27. The screening system of claim 19, further comprising, after the step (c), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image.

28. A method for reproducing a contone image as a multi-color halftone image on a recording medium, using threshold values in threshold matrices, comprising the steps of:

(a) providing a first base supercell suitable for periodically tiling a plane, the first base supercell having a first plurality of microdots and a first plurality of virtual halftone dot centers;

(b) providing a second base supercell suitable for periodically tiling a plane, the second base supercell having a second plurality of microdots and a second plurality of virtual halftone dot centers;

(c) assigning a first ordering sequence and a second ordering sequence to the virtual halftone dot centers in both base supercells, each ordering sequence comprising series of numbers, by:

(i) assigning a first number in the first ordering sequence to a first virtual halftone dot center in the first base supercell;

(ii) assigning a first number in the second ordering sequence to a first virtual halftone dot center in the second base supercell;

(iii) calculating a value of a combined aggregate distance function for each virtual halftone dot center from a first plurality of virtual halftone dot centers in the first base supercell not already included in the first ordering sequence;

(iv) selecting a first next virtual halftone dot center in the first base supercell in response to the value of the combined aggregate distance function calculated in step (iii), the first next virtual halftone dot center having one of the least values of the combined calculated aggregate distance function;

(v) assigning the next consecutive number in the first ordering sequence to the selected first next virtual halftone dot center in the first base supercell;

(vi) calculating a value of an combined aggregate distance function for each virtual halftone dot center from a second plurality of virtual halftone dot centers in the second base supercell not already included in the second ordering sequence;

(vii) selecting a second next virtual halftone dot center in the second base supercell in response to the value of the combined aggregate distance function calculated in step (vi), the second next virtual halftone dot

center having one of the least values of the combined calculated aggregate distance function;

(viii) assigning the next consecutive number in the second ordering sequence to the selected second next virtual halftone dot center in the second base supercell;

(ix) repeating steps (iii) through (viii), until each virtual halftone dot center in the first base supercell is included in the first ordering sequence and each virtual halftone dot center in the second base supercell is included in the second ordering sequence;

(d) assigning threshold values to microdots in response to the first ordering sequence thereby generating the first threshold matrix in the first base supercell;

(e) assigning threshold values to microdots in response to the second ordering sequence thereby generating the second threshold matrix in the second base supercell; and

(f) using the first threshold matrix and the second threshold matrix in combination with the contone image to generate a screened multi-color halftone image on the recording medium.

29. The method of claim 28, wherein the combined aggregate distance function for each virtual halftone dot center in the first plurality of virtual halftone dot centers in the first base supercell comprises a sum of a first component aggregate distance function and a second component aggregate distance function, wherein

(a) the first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence; each of the distances raised to a positive power, and

(b) the second component aggregate distance function comprises a first constant multiplied by a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence or in the second ordering sequence; each of the distances raised to a positive power.

30. The method of claim 29, wherein the first constant is less than one.

31. The method of claim 30, wherein the first constant equals to 0.5.

32. The method of claim 28, wherein the combined aggregate distance function for each virtual halftone dot center in the second plurality of virtual halftone dot centers in the second base supercell comprises a sum of a first component aggregate distance function and a second component aggregate distance function, wherein

(a) the first component aggregate distance function comprises a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the second ordering sequence; each of the distances raised to a positive power, and

(b) the second component aggregate distance function comprises a second constant multiplied by a sum of inverse distances from said virtual halftone dot center to each virtual halftone dot center already included in the first ordering sequence or in the second ordering sequence; each of the distances raised to a positive power.

33. The method of claim 32, wherein the second constant is less than one.

34. The method of claim 33, wherein the second constant equals to 0.5.

35. The method of claim 28, wherein the first virtual halftone dot center in the second base supercell is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the first base supercell.

36. The method of claim 35, wherein the distance between the first virtual halftone dot center in the first base supercell and the first virtual halftone dot center in the second

base supercell does not equal to the distance between the first virtual halftone dot center in the second base supercell and the periodic replication of the first virtual halftone dot center of the first base supercell in any supercells directly adjacent to the first base supercell.

37. The method of claim 28, further comprising, after the step (ii), and before step (iii), the step of assigning a second consecutive number in the first ordering sequence to a second virtual halftone dot center in the first base supercell; and assigning a second consecutive number in the second ordering sequence to a second virtual halftone dot center in the second base supercell.

38. The method of claim 37, wherein in each base supercell the second virtual halftone dot center is disposed asymmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

39. The method of claim 38, wherein in each supercell the distance between the second virtual halftone dot center and the first virtual halftone dot center does not equal to the distance between the second virtual halftone dot center and the periodic replication of the first virtual halftone dot center in any supercells directly adjacent to the base supercell.

40. The method of claim 37, wherein in each base supercell the second virtual halftone dot center is disposed symmetrically in relation to the periodic replication of the first virtual halftone dot center in any supercells adjacent to the base supercell.

41. The method of claim 28, wherein the first plurality of virtual halftone dot centers is arranged on a periodic grid having a first screen angle and screen ruling.

42. The method of claim 28, wherein the second plurality of virtual halftone dot centers is arranged on a periodic grid having a second screen angle and screen ruling.

43. The method of claim 28, further comprising, after the step (e), the step of rescaling the range of the threshold values according to a range of pixel values within the contone image.

44. The method of claim 28, wherein the first plurality of microdots and the second plurality of microdots is the same plurality of microdots.